Abstract of the Disclosure

A flywheel energy storage system having magnetic bearings that are preferably homopolar, that is, the magnetic fields do not alternate polarity around a given circumferential location. This significantly increases efficiency, reduces heating in the evacuated flywheel environment and reduces power requirements of the electronics. The magnetic bearings are also preferably permanent magnet biased. Permanent magnets provide bias flux in the magnetic bearings which produces several benefits. The bias flux linearizes and amplifies the response of the magnetic bearings for much easier and simpler control. Compared with designs using electromagnetic bias, permanent magnet bias results in lower power consumption and increased linearity in force to displacement response due to the large reluctance offered by the permanent magnets. Permanent magnet bias also allows use of only one amplifier per axes instead of two. This greatly reduces the costs and increases reliability.